

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, NY 10024
Number 3487, 11 pp., 9 figures

October 27, 2005

New Records and Observations on the Natural History of *Lisposoma elegans* and *L. josehermana* (Scorpiones: Bothriuridae)

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ABSTRACT

The endemic Namibian scorpion genus *Lisposoma* Lawrence, 1928 is a basal African lineage of the Gondwanan family Bothriuridae Simon, 1880. The natural history of *Lisposoma* remains poorly known. This contribution provides new records and observations on the natural history of *Lisposoma elegans* Lawrence, 1928 and *Lisposoma josehermana* Lamoral, 1979, based on recent fieldwork in Namibia.

INTRODUCTION

The endemic Namibian scorpion genus *Lisposoma* Lawrence, 1928 represents a basal African lineage of the Gondwanan family Bothriuridae Simon, 1880 (Prendini, 2000, 2003a, 2003b, 2005a). Other, more derived bothriurid genera occur in South America, India, and Australia, confirming a well-known biogeographical pattern attributed to the earlier separation of Africa from the post-Gondwana landmass that included South

America, India, and Australia (Brundin, 1965).

Prendini (2003b) revised the diagnoses and descriptions of *Lisposoma elegans* Lawrence, 1928 and *Lisposoma josehermana* Lamoral, 1979 (as *L. joseehermanorum*), provided a key to their identification, brief summaries of their ecology and conservation status, and a distribution map plotting all locality records known at the time. The distribution and natural history of *L. josehermana* (figs. 1, 2) remained more poorly known than that of *L. elegans*. Prendini (2003b: 262) observed:

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Most specimens of *L. joseehermanorum*, for which collection data are available, were taken from under

stones or captured in pitfall traps. Several specimens were found in caves (Märchenhöhle and Kemptenhöhle). According to Lamoral (1979), the types from Elandshoek were all found in burrows, deep below the undersurface of large boulders half imbedded in hard, slightly damp soil, on south-facing hills supporting a fairly dense Mopane/Acacia forest. No specimens were collected on south-facing hills supporting less dense vegetation. The habitat of *L. josehermanorum* is mesic, compared with that of *L. elegans*, and its facultative occurrence in caves prompted Lamoral (1979) to describe it as an endogean species occupying a euedaphic habitat.

Alexis Harington (pers. comm.) revisited Elandshoek and confirmed the habitat of *L. josehermanorum* to be as described by Lamoral (1979), but did not find any evidence for Lamoral's claim that this species is fossorial. As with *L. elegans*, *L. josehermanorum* does not display any obvious morphological characters suggestive of a fossorial existence and it seems unlikely that this species is capable of burrowing, although it is evidently lapidicolous.

At the time, only 22 specimens of *L. josehermana* had ever been collected (compared with 124 specimens of *L. elegans*), all from under stones or in pitfall samples. During December 2003–January 2004, an expedition to northern Namibia was conducted under the auspices of the Stavros Niarchos Foundation. Among numerous other sites, the Brandberg Massif (fig. 3), the Waterberg Plateau (fig. 4), and two localities in the Otavi Highlands, Farm Uisib 427 and Farm Varianto on Elandshoek 771 (figs. 5–8) were visited for several days each, during which time 145 additional specimens (including 27 adult males and 70 adult females) of *L. josehermana* were collected. Although some were collected by turning stones during the day, the majority were collected at night with the aid of ultraviolet (UV) light detection, and represent the first specimens of this species collected using that method. UV light detection also enabled observations on the microhabitat of *L. josehermana* to be recorded and documented for the first time, confirming, *inter alia*, that the species is, indeed, lapidicolous and not fossorial.

Several new specimens of *L. elegans* were also collected during the expedition, and additional specimens were located while sorting through the unidentified material of several museum collections. Some of these represent new records, including the first records of the species on the summit of the Brandberg Massif. This contribution also presents

the first records of *L. josehermana* from the Waterberg Plateau, a range extension for the species. On the basis of these findings, the distribution map of both species, first provided by Prendini (2003b), is updated (fig. 9), together with a complete listing of the known locality records.

MATERIAL AND METHODS

Personally collected specimens were located at night using a portable UV lamp, comprising two mercury-vapor tubes attached to a chromium parabolic reflector and powered by a rechargeable 7-Amp/h, 12-V battery, or by turning stones during the day. A portable Garmin GPS II Plus device was used for recording the geographical coordinates of collection localities in the field. Photographs were taken in visible light as well as under long-wave UV using a Microptics ML1000 digital imaging system.

Material examined is deposited in the following collections: National Museum of Namibia, Windhoek (NMNW); South African Museum, Cape Town (SAMC), some bearing accession numbers from the John Visser Collection (JV); Natal Museum, Pietermaritzburg, South Africa (NMSA); Transvaal Museum, Pretoria, South Africa (TMSA), most bearing accession numbers from the Sebastian Endrödy-Younga Collection (EY), as recorded by Lamoral (1979); American Museum of Natural History, New York (AMNH), some bearing accession numbers from the Alexis Harington Collection (AH); California Academy of Sciences, San Francisco (CASC); Zoological Museum, Lund University, Sweden (ZMLU); Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany (ZMUH). Tissue samples are stored (in the vapor phase of liquid nitrogen at -150°C) in the Ambrose Monell Collection for Molecular and Microbial Research (AMCC) at the AMNH. Names of Namibian regions and magisterial districts listed in the material examined follow the most recent system (post-1994).

Georeferences for new records were traced by reference to gazetteers, the official 1:250,000, 1:500,000 and 1:1,000,000 topocadastral maps of Namibia published by the Government Printer, and the GEONet Names

Server (GNS): http://earth-info.nga.mil/gns/html/cntry_files.html. The previously published spatial dataset of point locality records (Prendini, 2003b) was then updated, imported into ArcView GIS Version 3.2 (Environmental Systems Research Institute, Redlands, CA), and superimposed on coverages depicting the political boundaries of Namibia, the topography (600-m contour interval), and the major sand systems, obtained from the Namibian National Biodiversity Task Force (Barnard, 1998): <http://www.dea.met.gov.na/programmes/biodiversity/countrystudy.htm>.

FAMILY BOTHRIURIDAE SIMON, 1880

GENUS *LISPOSOMA* LAWRENCE, 1928

Lisposoma elegans Lawrence, 1928

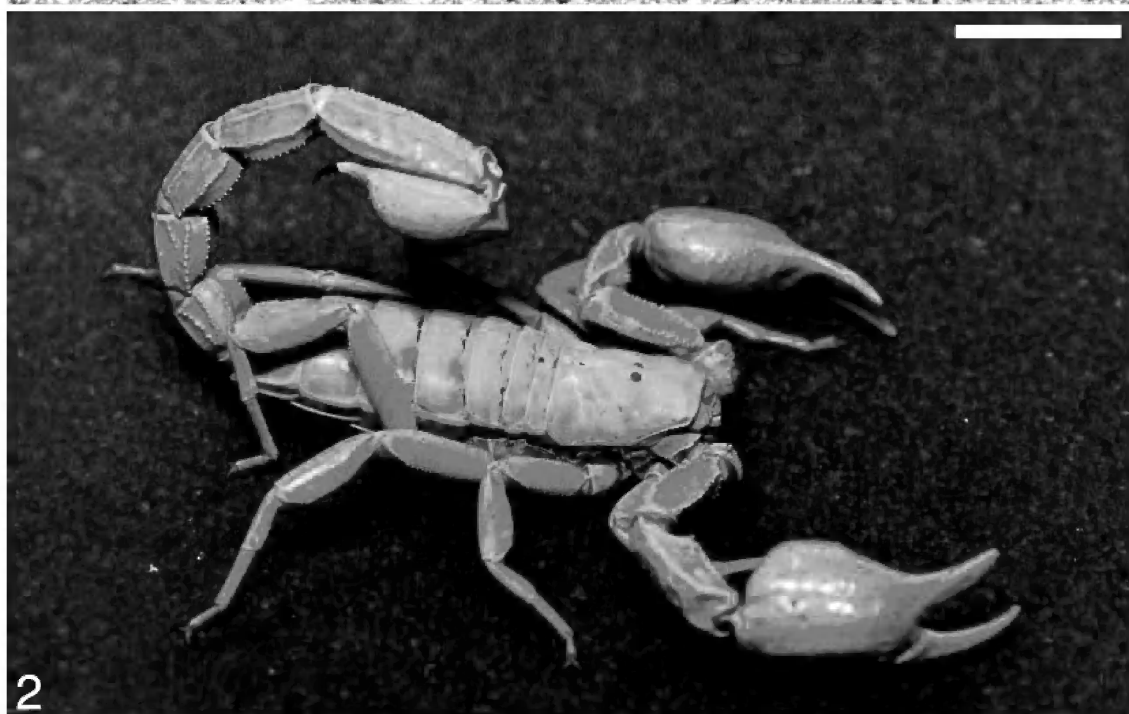
Lisposoma elegans Lawrence, 1928: 281–286, pl. XXIII, fig. 52–57, pl. XXIV, fig. 58.

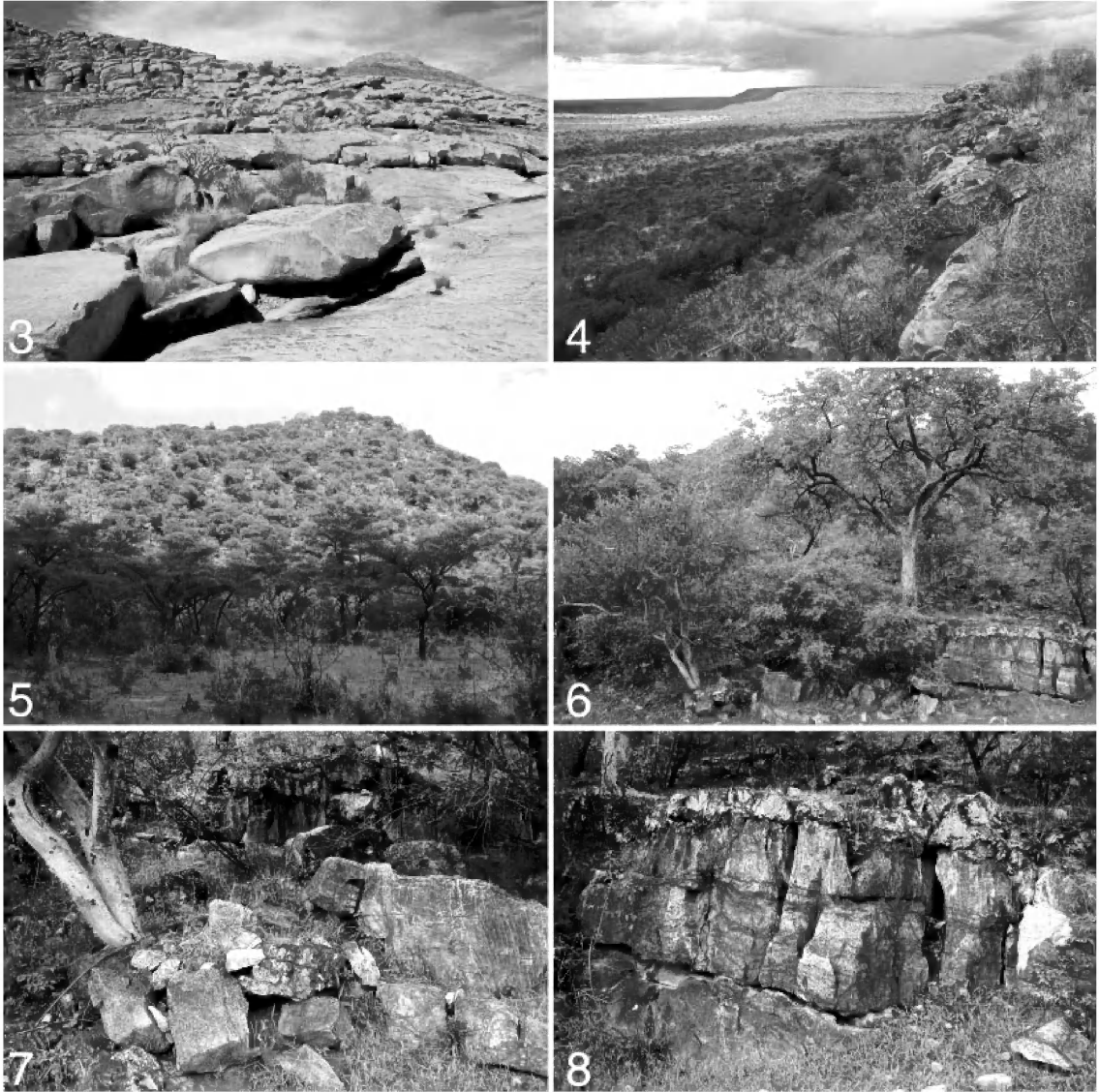
Lisposoma elegans: Werner, 1934: 274; Lawrence, 1955: 257; Vachon, 1974: 940, fig. 92, 102, 134–136; Lamoral & Reynders, 1975: 544; Lamoral, 1979: 662–665, fig. 318–326, 329, 330; Francke, 1982: 36; Lourenço, 1996: 85, fig. 2; Kovařík, 1998: 101; Lowe & Fet, 2000: 34; Lourenço, 2000: 39, fig. 20; Prendini, 2000: 40, table 3, figs. 2, 6; Prendini, 2001: 137; Prendini, 2003a: figs. 2–4, appendix 1; Prendini, 2003b: 247–257, 262, figs. 1–19, table 2; Fet et al., 2004: 195–207, table I, II, figs. 1, 3, 17, 20; Prendini, 2005a: 51, 70 (appendix 1).

TYPE MATERIAL: NAMIBIA: Kunene Region: *Opuwo District*: Lectotype ♀ (SAMC B6980), desig. Lamoral (1979: 663), Okorosave [Korosave, 18°10'S 13°48'E], South West Africa, i–iv.1926, S.A. Museum Expedition. Paralectotypes (desig. Lamoral, 1979: 663): Sesfontein [19°08'S 13°37'E], South West Africa, i–iv.1925, S.A. Museum Expedition, 1 ♀ 10 subad. ♀ (SAMC B6066/B6077). *Outjo District*: Kamanjab [19°38'S 14°50'E], South West Africa, ii.1925, S.A. Museum Expedition, 1 subad. ♂ (NMSA 16411 ex SAMC B6773); Outjo [20°07'S 16°09'E], South West Africa, i–iv.1926, S.A. Museum Expedition, 1 ♂ 3 subad. ♂ (SAMC B6077).

ADDITIONAL MATERIAL: NAMIBIA: Eron-go Region: *Karibib District*: 20 km E Namib-Naukuft Park gate on Us Pass road, 23°07'S 15°44'E, 15.xi.1974, S. Endrödy-

Younga, pitfall trap, 1 subad. ♂ (TMSA 12420 [EY 470B]); 30 km E Namib-Naukuft Park gate on Us Pass road, 23°05'S 15°49'E, 15.xi.1974, S. Endrödy-Younga, pitfall trap, 2 ♂ (TMSA 12422–12423 [EY 471G]). *Omaruru District*: 20 km S of Omatjetje-Khorixas junction [21°03'S 14°53'E], 6.ii.1981, A. Harington, near rocky hill, ground was sandy, area basically flat, 1 ♂ (AMNH [AH 2133]); Tsisab ravine foot [Brandberg], 21°05'S 14°40'E, 27.ii–20.vi.1995, E. Marais, preservative pitfall trap, 1 juv. ♀ (NMNW 1861); Brandberg, N end Tsisab, 21°05'S 14°40'E, 21.i–27.ii.1995, E. Marais, preservative pitfall traps, 1 ♂ 1 ♀ (NMNW 1860); Brandberg, summit, below Longipoele, 21°11'34.9"S 14°33'23.9"E, 23.xii.2003, L. Prendini, T. Bird, & N. Krone, collected with UV light on warm, dark, still night, in dry watercourse surrounded by granite slopes and boulders, with a fairly dense *Acacia* thicket in places, specimens sitting on ground surface, 1794 m, syntopic with *Parabuthus brevimanus* (Thorell, 1876), *Uroplectes otjimbinguensis* (Karsch, 1879) (in bushes and trees), *U. planimanus* (Karsch, 1879), *Hadogenes tityrus* (Simon, 1888), and *Opisthophthalmus carinatus* (Peters, 1861), 1 ♂ (AMCC 138987), 1 ♂ (AMNH); Brandberg, summit, between Longipoele and Helmpoele, 21°11'33.2"S 14°33'31.4"E, 23.xii.2003, L. Prendini, T. Bird, & N. Krone, collected with UV light on warm, dark, still night, in sheltered, flat sandy valley with granite domes and boulders intersected by dry watercourses, granitic loam soil with *Stipagrostis-Aristida* grassland, *Boscia*, *Cyphostemma*, *Euphorbia*, and *Ozoroa* in rocky areas, specimen sitting on ground surface, 1830 m, syntopic with *P. brevimanus*, *U. otjimbinguensis* (in bushes and trees), *U. planimanus*, and *O. carinatus*, 1 ♂ (AMNH). *Swakopmund District*: Rössing Mine, Arandis Control Site, 22°08'S 15°00'E, 13.iii–9.iv.1984, E. Griffin, preservative pitfall traps, 1 ♂ 1 subad. ♂ 3 juv. ♀ (NMNW 826), same data, except “9.iv–8.v.1984”, 1 ♀ (NMNW 832); Rössing Mine, Arandis Site, 22°22'S 14°59'E, 11.ii–11.iii.1985, J. Irish & H. Rust, preservative pitfall traps, 1 juv. ♂ (NMNW 890), same data, except “11.iii–9.iv.1985”, 1 subad. ♂ (NMNW 901); Rössing Mine, Crusher Dust





Figs. 1–2. *Lisposoma josehermana* Lamoral, 1979, adult ♂, in life. 1. Natural light. 2. Ultraviolet light. Scale bar = 10 mm.

Figs. 3–8. Collection localities for *Lisposoma* Lawrence, 1928 in Namibia. 3. Brandberg Massif, summit, near Helmpoele, habitat of *Lisposoma elegans* Lawrence, 1928. 4. Waterberg Plateau, southern edge, habitat of *Lisposoma josehermana* Lamoral, 1979: wooded thicket below cliff face. 5–8. Farm Varianto on Elandshoek 771, Otavi Highlands, habitat of *L. josehermana*. 5. Rocky slopes in wooded thicket at base of hill. 6. Dolomite boulders and rock faces at base of wooded slope, where specimens were collected. 7, 8. Microhabitat: specimens were observed sitting and walking on rock faces and in crevices at night.

Area, 22°27'S 15°02'E, 13.iii–9.iv.1984, E. Griffin, preservative pitfall traps, 1♂ (NMNW 829), same data, except "9.iv–8.v.1984", 1♀ (NMNW 839); Rössing Mine, Crusher Dust Area, 22°28'S 15°02'E, 11.ii–

11.iii.1985, J. Irish & H. Rust, preservative pitfall traps, 6♂ 3♀ 1 subad. ♂ (NMNW 897), same data, except "11.iii–9.iv.1985", 1♀ 1 juv. ♂ (NMNW 910); Rössing Mine, Dome Gorge, 22°28'S 15°04'E, 11.ii–

11.iii.1985, J. Irish & H. Rust, preservative pitfall traps, 2♂ 1 subad. ♂ 2 subad. ♀ 1 juv. ♀ (NMNW 898), same data, except "11.iii–9.iv.1985", 1♂ (NMNW 912), same data, except "5.iv–6.v.1985", 1 juv. [sex indet.] (NMNW 918); Rössing Mine, Lower Ostrich Gorge, 22°30'S 14°58'E, 11.iii–9.iv.1985, J. Irish & H. Rust, preservative pitfall traps, 1 subad. ♂ (NMNW 909); Rössing Mine, Upper Ostrich Gorge, 22°29'S 14°59'E, 11.ii–11.iii.1985, J. Irish & H. Rust, preservative pitfall traps, 1♂ 1♀ 1 juv. ♀ (NMNW 891), same data, except "11.iii–9.iv.1985", 1♀ (NMNW 905), same data, except "5.iv–6.v.1985", 1 subad. ♂ (NMNW 915). Namib-Naukluft Park: Gobabeb [23°34'S 15°03'E], 26.i.1975, S. Endrödy-Younga, pit-

fall trap, 3♂ 1 juv. ♂ 1 juv. ♀ (TMSA 11114), 1♀ (TMSA 11111); 42 km along Mirabib road from Gobabeb [23°25'S 15°26'E], 28.ii.1975, S. Endrödy-Younga, pitfall trap, 1 subad. ♀ 1 juv. ♂ (TMSA 11104); Volstruishoogte [23°00.64'S 15°24.74'E], 26.i.1998, L. Prendini & E. Scott, under ironstone, 360 m, 1♂ (AMCC 139001). **Khomas Region:** Windhoek District: 44 km E Namib-Naukluft Park gate on Us Pass road, 23°04'S 15°56'E, 24.i.1975, S. Endrödy-Younga, pitfall trap, 1 juv. ♀ (TMSA 12427 [EY 583B]), same data, except "5.vi.1975", 1♀ (TMSA 12429 [EY 586E]), 1 subad. ♂ (TMSA 12430 [EY 586E]); 46 km E Namib-Naukluft Park gate on Us Pass road, 23°03'S 15°58'E, 2.iii.1974,

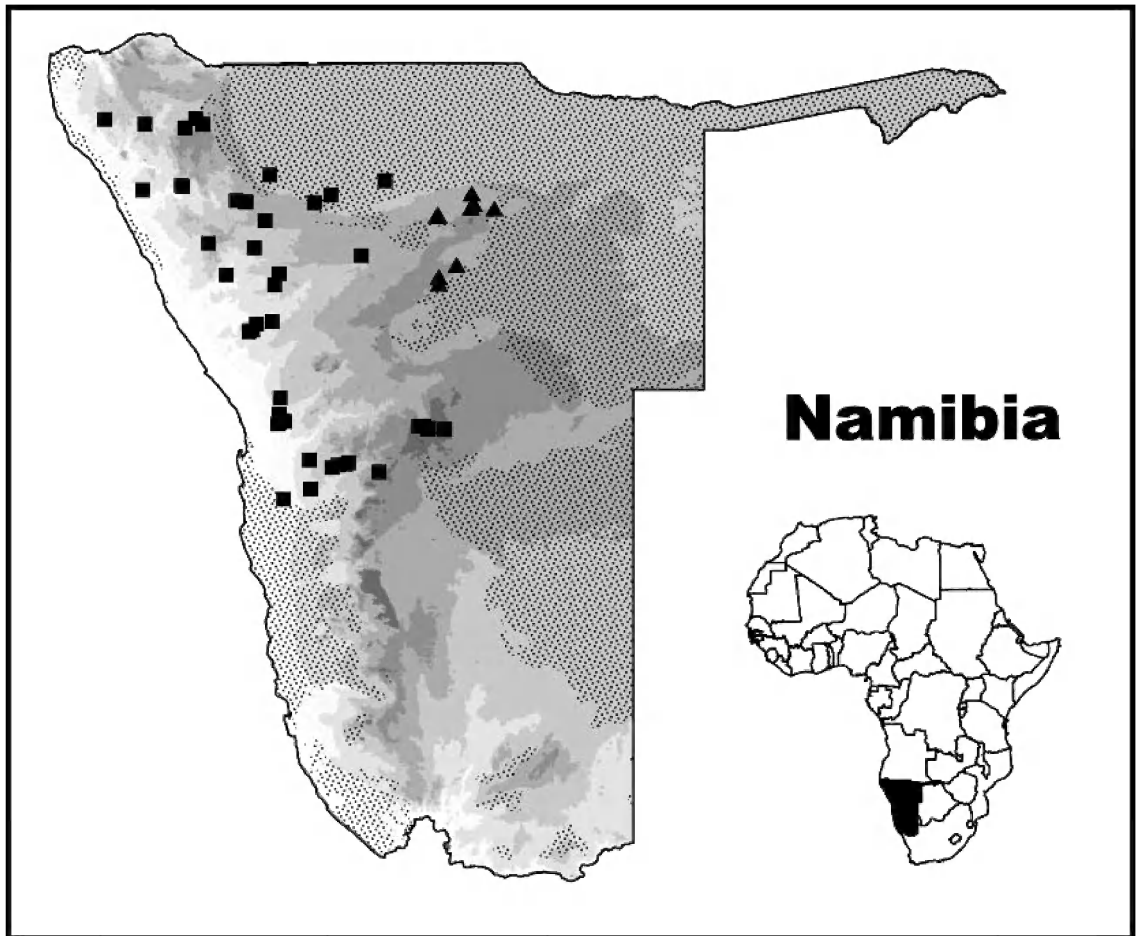


Fig. 9. Map showing the known distributions of *Lisposoma elegans* Lawrence, 1928 (■) and *Lisposoma josephermans* Lamoral, 1979 (▲) in Namibia (contour interval 600 m; major sand systems stippled).

S. Endrödy-Younga, pitfall trap, 1 subad. ♂ (TMSA 12428 [EY 719]), same data, except "3.vi.1975", 1 subad. ♂ 2 juv. ♀ (TMSA 12459 [EY 857G]), same data, except "5.vi.1975", 1 subad. ♂ (TMSA 12431 [EY 857]), 1 subad. ♀ (TMSA 12432 [EY 857]), 1 subad. ♀ (TMSA 12433 [EY 857]); Top of Us Pass, 23°03'S 15°58'E, 7.vii.1978, S. Endrödy-Younga, pitfall trap, 1 ♀ (TMSA 12217 [EY 1474]), 4 subad. ♂ (TMSA 12213–12216 [EY 1474]); Daan Viljoen [Game Reserve], near Windhoek [22°32'S 16°58'E], 12.xii.1978, A. Harington, under a very large stone, 1 juv. ♀ (AMNH [AH 833]); Farm Portsmut 33, Hakos Mountains, 23°11'S 16°24'E, 7.ii.1969, B. Lamoral & R. Day, 2♂ 1 subad. ♀ (NMSA 10035 [B.6773]); Farm Voigtland a. d. Bismarck-Bergen (38 km E Windhoek) [22°35'S 17°20'E], 16–19.v.1911, W. Michaelsen, 1 ♀ 1 juv. ♂ (ZMUH); Goreangab Dam, Windhoek, 22°32'S 17°02'E, 19.xii.1973, State Museum staff (C.G. Coetzee, M.-L. Penrith, J. Buys, E. Marais, & S. Oosthuizen), 1 ♀ (NMNW 503 [old 63]); Windhoek, Eros Mt. [22°34'S 17°06'E], 2.xii.1974, S. Endrödy-Younga, 1 ♀ (TMSA 20250), 1 ♀ 1 subad. ♂ (TMSA 20251), 11.xi.1974, S. Endrödy-Younga, 1♂ 1♀ (TMSA 21629); Windhoek [22°34'S 17°05'E], 29.iv–8.v.1911, W. Michaelsen, 1 ♀ (ZMUH). **Kunene Region:** *Khorixas District:* Farm Annabis 677, 20°00'S 14°38'E, 23–24.ii.1969, B. Lamoral & R. Day, 1 ♀ (NMSA 10032); Farm Vrede 719, 20°23'S 14°14'E, 31.iii.1976, B. Lamoral & L. Ferguson, on surface near rocky and sandy marginal area south of road at night, 1 ♀ (NMSA 10885); 2 km E Khorixas [20°22'S 14°59'E], 19.iv.1980, L. Harington, drowned in water trough, 1 ♀ (AMNH [AH 1448]); Farm Welbedaght 584 [Welbedacht 394], near Khorixas [20°31'S 14°55'E], 20.iv.1980, A. Harington, under an irregular rock on a fairly steep, extremely rocky hillside, sparse grass, 1 ♀ (AMNH [AH 1345]); Hobatere Lodge, Farm Marenphil 641, 19°20'S 14°23'E, 19–20.i.1998, L. Prendini & E. Scott, 1050 m, granitic hills and sandy loam flats near camp, UV detection at night, 3♂ (AMNH); Palm, 19°57'S 13°59'E, 21.i.1998, L. Prendini & E. Scott, 1000 m, dolerite rocky flats, loam soil, UV detection at night, 1♂ (AMNH). *Opuwo District:* An-

abib (Orupembe) [18°11'S 12°31'E], 100 mi W Ohopoho, 4 mi SW of waterhole, 8.vi.1951, P. & G. Brinck, G. & I. Rudebeck, on plain covered by dry vegetation, under stones, 1♂ 1♀ (ZMLU L51/4288), 1♂ (ZMLU L51/4287 [old 1525]); between Anabib [Orupembe, 18°11'S 12°31'E] and Omutati [Okomutati, 18°15'S 13°05'E], 6.vi.1951, P. & G. Brinck, G. & I. Rudebeck, on dry hill side with scattered mopane bushes, 1♂ (ZMLU L51/4286 [old 1527]); Orumana [18°15'S 13°54'E], 10.ii.1975, 1 subad. ♂ (NMNW 593); Sesfontein, 10 km W of clinic, 19°07'S 13°36'E, 4.iv.1976, B. Lamoral & L. Ferguson, on gritty and stoney ground at night, 7♀ [2 missing] 1 subad. ♀ (NMSA 10886); Sima Hill, 3 km NW [19°11'S 13°03'E], 1.iv–30.vi.1985, pitfall trap, 1♂ 1♀ (NMNW 1164); Sima Hill, 4 km W [19°11'S 13°03'E], 1.iv–30.vi.1985, pitfall trap, 2♀ (NMNW 1158). *Outjo District:* Tandal Ridge, Farm Windpoort 428 [19°21.489'S 15°29.028'E], 15.xii.1999, T.O. Osborne, dolomite ridge, syntopic with *O. carinatus*, 1♀ (NMNW 2674 [old 2125]), same data, except "ii.2000", 1 subad. ♀ (NMNW 2675 [old 2144]). Etosha National Park: Helio, 19°03'S 16°29'E, 14.ii–23.iii.1987, E. Griffin, preservative pitfall traps, 2♂ 2♀ 1 subad. ♂ 3 subad. ♀ 1 juv. ♂ 5 juv. ♀ (NMNW 999), same data, except "27.iii–4.v.1988", 1♀ 1 juv. ♀ (NMNW 1091); Karossfontein, 19°21'S 14°31'E, 9.ii–20.iii.1987, E. Griffin, preservative pitfall traps, 1♂ 1♀ (NMNW 984); Olifantsrus, 18°58'S 14°51'E, 8.vi–8.vii.1987, E. Griffin, in reptile trap, 1 specimen [not examined] (NMNW 1204); Ondundozonananandana Mts, 19°15'S 15°43'E, 10.x–30.xi.1986, E. Griffin, preservative pitfall traps, 3 specimens [not examined] (NMNW 961).

DISTRIBUTION: *Lisposoma elegans* is now known from 46 localities, falling within 39 quarter-degree squares (QDS), in the Kunene Region (Khorixas, Opuwo, and Outjo districts), Khomas Region (Windhoek District), and Erongo Region (Karibib, Omaruru, and Swakopmund districts) of central and north-western Namibia (fig. 9). The species has been recorded within four protected areas: Brandberg National Monument, Daan Viljoen Game Reserve, Etosha National Park, and Namib-Naukluft Park. Although it was

previously recorded at the base of the Brandberg (Prendini, 2003b), the present study provides the first records from the summit of the massif, which also represents the highest record for the species (1830 m; the lowest record is 360 m).

NATURAL HISTORY: As with most other specimens of *L. elegans*, the new specimens were collected in pitfall traps or by means of UV light detection at night. All specimens were collected in stony areas with hard, gritty substrata (fig. 3) and no additional evidence contradicts the opinion that the species is lapidicolous and not fossorial (Prendini, 2001, 2003b).

Lisposoma josehermana Lamoral, 1979

Lisposoma josehermana Lamoral, 1979: 665–668, fig. 327, 328, 331–340.

Lisposoma josehermana: Francke, 1982: 36; Kovarik, 1998: 101; Prendini, 2000: 40, table 3, figs. 2, 6, 8A; Fet et al., 2004: 195–207, table I, II, figs. 2, 4, 8, 11, 15, 18, 20; Acosta and Fet, 2005: 4.

Lisposoma josehermanorum: Lowe and Fet, 2000: 34; Prendini, 2001: 137; Prendini, 2003a: figs. 2–4, appendix 1; Prendini, 2003b: 247, 257–262, figs. 1, 2, 18–34, table 2; Prendini, 2005a: 45, 51, 70 (appendix 1).

NOMENCLATURE: Following Acosta and Fet (2005), Lamoral's (1979) original specific epithet, *josehermana*, is used, rather than Lowe and Fet's (2000) unjustified emendation, subsequently cited by Prendini (2001, 2003a, 2003b, 2005a).

TYPE MATERIAL: NAMIBIA: Oshikoto Region: Tsumeb District: Holotype ♂ (NMSA 10697 [Type No. 2223]), Farm Elandshoek 771, 19°26'S 17°42'E, Otavi Highlands, 8.iii.1969, B. Lamoral & R. Day. Paratypes: same data as holotype, 1 subad. ♂ (NMNW 765 ex NMSA 11110), 2 juv. ♂ (NMSA 11110 [Type No. 2224]). **Otjozondjupa Region: Grootfontein District:** Märchenhöhle, Farm Uisib 427, 19°32'S 17°14'E, 13.ii.1977, P. von Wrede, found in cave, 1 subad. ♀ (NMSA 11388 [Type No. 2297]); same data, except "7.viii.1977", 1 ♀ (NMSA 11389 [Type No. 2298]); Kempton (Höhle) [19°33'S 17°14'E, Farm Uisib 427], 6.viii.1977, P. von Wrede, ges. im Lehm Canon (found in cave), 1 subad. ♂ (NMSA 11390 [Type No. 2299]).

ADDITIONAL MATERIAL: NAMIBIA: Oshikoto Region: Tsumeb District: Farm Elandshoek 771, ca. 10 km SW Tsumeb, Otavi Highlands [19°26'S 17°42'E], 25.iv.1980, A. Harington, under ill fitting stones on S slope of hillside, no burrows or scrapes, leaf littered, 1 ♀ 1 juv. ♀ (AMNH), 1 subad. ♂ (AMNH [AH 1342]), 1 subad. ♀ (AMNH [AH 1344]), 1 juv. ♂ (AMNH [AH 1343]); Elandshoek, Tsumeb, 19°14'S 17°43'E, 1–16.iv.1984, J. Visser, 1 ♂ (SAMC C4333 [JV 3207]), 1 ♀ (SAMC C4331 [JV 3157]), 1 ♀ (SAMC C4332 [JV 3208]); Farm Varianto on Elandshoek 771, 19°22.773'S 17°44.456'E, 4.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, collected with UV light on warm, still, very humid night after rain, completely overcast with slight, occasional drizzle, walking or sitting on rocks and rockfaces, on the ground, or in crevices (two pairs in copula), on and at the base of rocky dolomite slopes (especially S- and E-facing) in dense broadleaf woodland with *Burkea*, *Dichrostachys*, *Commiphora*, *Terminalia*, 1500 m, syntopic with *Parabuthus kraepelini* Werner, 1902, *U. planimanus*, *Hadogenes hahni* (Peters, 1862), and *O. carinatus*, 16 ♂ 54 ♀ (AMNH), 5 ♂ 9 ♀ 6 subad. ♂ 1 subad. ♀ (NMNW 2677), 7 juv. ♂ 4 juv. ♀ (AMCC 138989). **Otjozondjupa Region: Grootfontein District:** Märchenhöhle [19°32'S 17°14'E], 30.viii.1990, E. Marais, 1 ♀ (NMNW 1352), 30.viii.1990–7.iv.1991, E. Marais, preservative pitfall trap, 1 ♀ (NMNW 1622); Farm Uisib 427, 15 km NW of Otavi, on slopes and near base of mountain, 19°33.132'S 17°14.124'E, 2.i.2004, L. Prendini, E. Scott, T. & C. Bird, Q. & N. Martins, collected from under stones, often in dense leaf litter, during the day, and with UV light on warm, humid night, last quarter moon, sitting or walking on rock faces and rock crevices, mostly at the base of a rocky dolomite slope in dense broadleaf thicket with *Dichrostachys*, *Spirostachys*, and *Sclerocarya*, 1293 m, sympatric with *P. kraepelini*, *U. otjimbinguensis* (in trees), *H. hahni*, *O. carinatus*, and *Opisthophthalmus fitzsimonsi* Hewitt, 1935, ♂ 7 ♀ 5 subad. ♂ 5 subad. ♀ (AMNH), 6 subad. ♂ 4 subad. ♀ (NMNW 2676), 6 juv. ♂ 4 juv. ♀ (AMCC 138988), near farmhouse, 19°33.113'S 17°13.087'E, 3.i.2004, L. Prendini, E. Scott, T. & C. Bird,

Q. & N. Martins, under calcrete stone on open sandy plain, sympatric with *P. brevipennis*, *P. kraepelini*, *O. carinatus*, and *O. fitzsimonsi*, 1343 m, 1 juv. ♀ (AMNH); Tsumeb, 27 mi SE [19°27'S 18°02'E], 19–20.xii.1966, E.S. Ross & K. Lorenzen, 1400 m, 1♂ 2♀ (CASC). Otjiwarongo District: Waterberg, 15 mi NE [20°15'S 17°30'E], 21.xii.1966, E.S. Ross & K. Lorenzen, 1470 m, 1♀ (CASC). Waterberg Plateau Park: Bernabé de la Bat Rest Camp, below cliff face, 20°30.803'S 17°14.753'E, 1.i.2004, L. Prendini, E. Scott, Q. & N. Martins, collected with UV light on warm, still, humid night, half moon obscured by clouds (partly overcast), on SE slope of Waterberg, in fairly dense broadleaf woodland with *Acacia*, *Aloe*, *Dicrostachys*, especially just below cliff face, specimen sitting on ground between stones, midway upslope, 1440 m, sympatric with *U. otjimbinguensis* (in trees), *U. planimanus*, *H. hahni*, and *O. carinatus*, 1♂ (AMNH); Waterberg Plateau, on top [20°25'S 17°15'E], ii–iii.1990, W. Versfeld, 1♀ (NMNW 2223).

DISTRIBUTION: *Lisposoma josehermana* is now known from 10 localities, falling within six QDS, in the Oshikoto Region (Tsumeb District) and the Otjozondjupa Region (Grootfontein and Otjiwarongo districts) of northeastern Namibia (fig. 9). It is recorded, for the first time, from the Waterberg Plateau and at least one specimen has been collected from within the borders of the Waterberg Plateau Park. The new record from Bernabé de la Bat Rest Camp is the southernmost record and a range extension for the species.

NATURAL HISTORY: All newly collected specimens of *L. josehermana* were found on and particularly at the base of steep, rocky slopes or cliff faces, in dense broadleaf woodland or thicket habitats supporting a fairly lush undergrowth of grasses and herbs (figs. 4, 5). Although they occur at similar elevations, the Mountain Savanna and Karstveld (Giess, 1971) habitats at the two localities in the Otavi Highlands (Uisib and Varianto), where most of the specimens were collected, were noticeably more mesic than the Tree Savanna and Woodland (Giess, 1971) habitat at the Waterberg, where only a single, much smaller adult male was collected. The geology of the two mountain ranges is also quite different: The Otavi Highlands

are composed of limestone and dolomite, which is more porous than the sandstone that makes up the caprock of the Waterberg.

At Uisib, several specimens were taken from under stones during diurnal searches. In all cases, the stones under which specimens were found, were situated in the shade of large trees and usually also close to large rock outcrops (figs. 6, 7). Many of these stones contained a moderately to well-developed layer of damp humus underneath; specimens were typically found sitting on or in the humus layer. Several adult specimens were collected under large stones, embedded in a dense layer of litter, in the shade of a large *Ficus* tree near the entrance to Märchenhöhle (a vertical cave). The cave was entered and inspected but no specimens were collected inside it. Previous records of the species in the Märchenhöhle and nearby Kempthöhle (Lamoral, 1979; J. Irish, personal commun.) must represent facultative occurrences; the species exhibits no obvious troglomorphies. No specimens were collected in burrows, contrary to the claims of Lamoral (1979: 668).

Most of the specimens collected at Uisib, as well as all the specimens collected at Varianto and the Waterberg, were captured on still, moonless nights with the aid of UV light detection (fig. 2). The greatest number of specimens were collected on two very humid nights (2 and 4 January, 2004), following convectional thunderstorms that occurred in the late afternoon. Many of these were sitting or walking on large rocks, boulders, or vertical rockfaces in the shade of large trees, but several were observed retreating into large crevices in rock outcrops (fig. 8), some of which were also inhabited by the liochelid, *Hadogenes hahni* (Prendini, 2005b). At Varianto, two pairs of *L. josehermana* were observed copulating on these rock faces and it seems probable that the specimens in question inhabited these crevices during the daytime. At Uisib, a large male (figs. 1, 2) was found under a large slab of rock resting on top of a rock outcrop, a microhabitat also typically occupied by liochelid scorpions such as *H. hahni*. These observations provide behavioral evidence for the suggestion, based on ecomorphology, that *L. josehermana* is lapidicolous and not fossorial (Prendini,

2003b). Indeed, the species may even be considered a facultative lithophile (Prendini, 2001).

Besides *H. hahni*, *L. josehermana* was syntopic with the buthids *Uroplectes otjimbinguensis* and *U. planimanus* and the scorpionid *Opisthophthalmus carinatus* at the Waterberg. In the Otavi Highlands, *L. josehermana* was recorded in sympatry with these species, and also with the buthids *Parabuthus brevimanus* and *P. kraepelini* and the scorpionid *Opisthophthalmus fitzsimonsi*. However, it was syntopic only with *H. hahni*, *U. planimanus*, and *O. carinatus*. *Uroplectes otjimbinguensis* was found exclusively in bushes and trees, whereas *O. fitzsimonsi* and the *Parabuthus* species were collected in more exposed, open sandy areas.

ACKNOWLEDGMENTS

Financial support for the 2003/2004 Constantine S. Niarchos Expedition to Namibia, during which many of the specimens and observations in this paper were obtained, was provided by the Stavros Niarchos Foundation, and I thank Maria Niarchos and Stephane Gouaze for their interest in this research. Additionally, I thank Holger Kolberg (Ministry of Environment and Tourism [MET], Government of Namibia) for issuing permits to collect scorpions in Namibia; Tharina Bird (NMNW) for assisting with the permit application process; Andre and Jenny Schoeman (Uisib) and Piet and Heidi Basson (Varianto) for hospitality while visiting their farms; Elizabeth Scott, the late Nicholas Krone, Chris and Tharina Bird, and Quinton and Nicole Martins for participating in the expeditions and personally collecting some of the specimens; Charles Griswold and Darrell Ubick (CASC), Guy Redman and Debbie Jennings (NMSA), Tharina Bird (NMNW), Margie Cochrane and Dawn Larsen (SAMC), Paul Bayliss, Klaas Manamela, and Barbara Dombrowsky (TMSA), Lennart Cederholm and Roy Danielsson (ZMLU), and Hieronymus Dastych (ZMUH) for assisting with the loan of specimens and/or allowing access to the collections under their care during my visits; Phoebe Barnard and Tony Robertson (Namibian National Biodiversity Task Force, MET) for permission to

use GIS coverages; Randy Mercurio (AMNH) for taking the live photographs; and Steve Thurston (AMNH) for preparing the photographic plates. This contribution is dedicated to the memory of Nicholas Krone.

REFERENCES

- Acosta, L.E., and V. Fet. 2005. Nomenclatural notes in Scorpiones (Arachnida). *Zootaxa* 934: 1–12. Available from: <http://www.mapress.com/zootaxa/>.
- Barnard, P. 1998. Biological diversity in Namibia: a country study. Windhoek: Namibian National Biodiversity Task Force, 325 pp.
- Brundin, L. 1965. On the real nature of transatlantic relationships. *Evolution* 19: 496–505.
- Fet, V., M.E. Soleglad, and F. Kovařík. 2004. Subfamily Lisposominae revisited (Scorpiones: Bothriuridae). *Revista Ibérica de Aracnología* 10: 195–209.
- Francke, O.F. 1982. Are there any bothriurids (Arachnida, Scorpiones) in southern Africa? *Journal of Arachnology* 10: 35–40.
- Giess, W. 1971. A preliminary vegetation map of South West Africa. *Dinteria* 4: 1–114.
- Kovařík, F. 1998. Štíři [Scorpions]. Jihlava: Madagaskar, 175 pp. [in Czech]
- Lamoral, B.H. 1979. The scorpions of Namibia (Arachnida: Scorpionida). *Annals of the Natal Museum* 23: 498–783.
- Lamoral, B.H., and S.C. Reynders. 1975. A catalogue of the scorpions described from the Ethiopian faunal region up to December 1973. *Annals of the Natal Museum* 22: 489–576.
- Lawrence, R.F. 1928. Contributions to a knowledge of the fauna of South-West Africa. VII. Arachnida (Part 2). *Annals of the South African Museum* 25: 217–312.
- Lawrence, R.F. 1955. Solifugae, scorpions and Pedipalpi, with checklists and keys to South African families, genera and species. Results of the Lund University Expedition in 1950–1951. In B. Hanström, P. Brinck, and G. Rudebeck (editors), *South African animal life* 1: 152–262. Uppsala: Almqvist and Wiksells.
- Lourenço, W.R. 1996. Can a bothriurid scorpion be present in the Himalayas of India? *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 12: 83–90.
- Lourenço, W.R. 2000. Panbiogéographie, les familles des scorpions et leur répartition géographique. *Biogeographica* 76: 21–39.
- Lowe, G., and V. Fet. 2000. Family Bothriuridae Simon, 1880. In V. Fet, W.D. Sissom, G. Lowe, and M.E. Braunwalder (editors), *Catalog of the scorpions of the world (1758–1998)*: 17–53. New York: New York Entomological Society.

- Prendini, L. 2000. Phylogeny and classification of the Superfamily Scorpionoidea Latreille 1802 (Chelicerata, Scorpiones): an exemplar approach. *Cladistics* 16: 1–78.
- Prendini, L. 2001. Substratum specialization and speciation in southern African scorpions: the Effect Hypothesis revisited. In V. Fet and P.A. Selden (editors), *Scorpions 2001: In memoriam Gary A. Polis*: 113–138. Burnham Beeches, UK: British Arachnological Society.
- Prendini, L. 2003a. A new genus and species of bothriurid scorpion from the Brandberg Massif, Namibia, with a reanalysis of bothriurid phylogeny and a discussion of the phylogenetic position of *Lisposoma* Lawrence. *Systematic Entomology* 28: 149–172.
- Prendini, L. 2003b. Revision of the genus *Lisposoma* Lawrence, 1928 (Scorpiones: Bothriuridae). *Insect Systematics and Evolution* 34: 241–264.
- Prendini, L. 2005a. Scorpion diversity and distribution in southern Africa: pattern and process. In B.A. Huber, B.J. Sinclair, and K.-H. Lampe (editors), *African biodiversity: molecules, organisms, ecosystems. Proceedings of the 5th International Symposium on Tropical Biology*, Museum Alexander Koenig, Bonn: 25–68. New York: Springer Verlag.
- Prendini, L. 2005b. On *Hadogenes angolensis* Lourenço, 1999 syn. n. (Scorpiones, Liochelidae), with a redescription of *H. taeniurus* (Thorell, 1876). *Revue Suisse de Zoologie* 112: 1–28.
- Vachon, M. 1973 [1974]. Étude des caractères utilisés pour classer les familles et les genres de scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les scorpions. *Bulletin du Muséum National d'Histoire Naturelle* (Paris), ser. 3, 140: 857–958.
- Werner, F. 1934. Scorpiones, Pedipalpi. In H.G. Bronn (editor), *Klassen und Ordnungen des Tierreichs* 5, IV, 8, Lief. 1–2, Scorpiones: 1–316. Leipzig: Akademische Verlagsgesellschaft.

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